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Index at acceptance - 9A+F [XXXIII(I)]

International classification - C 22 c 23/00

"Process for the preparation of improved alloy of magnesium for use as galvanic anode"

Council of Scientific and industrial Research Rafi Marg, New Delhi-1, India, an Indian Registered body incorporated under the Registration of Societies Act (Act XXI of 1860).

The following specification describes the nature of this invention :-

This is an invention by Dr. Narayanaswamy Subramanyan, Scientist, Dr. Krishnaswami Balakrishnan, Scientist, Dr. Subramanian Venkatakrishna Iyer, Scientist, and Sri Mahadeva Iyer Krishnan, Previously Junior Scientific Assistant of the Central Electrochemical Research Institute, Karaikudit, Tamil Nadu, India, now student, Electrochemistry Department, Georgetown University, Washington D.C., all Indian citizens.

Price Rs.2.00/-

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This invention relates to an alloy of magnesium containing misch-metal for use as galvanic anode.

Hitherto it has been proposed to prepare magnesium alloy containing aluminium and zinc for use as galvanic anode.

This is open to the objection that these alloys are not efficient unless special precautions are taken to keep down other metallic impurities like iron below specified levels and to counteract the harmful influence of even the minimum amount of iron by addition of magnanese.

The object of this invention is to employ ordinary commercial grade mageesium for making alloys suitable for use as galvanic anode.

To these ends, the invention broadly consists in incorporating 1 to 5% of misch-metal in the alloy made with commercial grade magnesium, commercial grade aluminium (Indal 2-5) (5-10%) and electrolytic zinc (0.5 to 5%).

The following typical examples are given in tabular form to illustrete the invention :

Anode efficiency (%) of Magnesium and its alloys

No.	Anode material	in 3% Nacl at		in 2N Nacl at		in 2N $Mg(ClO_4)_2$ at	
		1 mA/cm^2	10 mA/cm^2	1 mA/cm^2	10 mA/cm^2	1 mA/cm^2	10 mA/cm^2
1.	Megesium	21	44	17	46	31	57
2.	Mg + Al + Zn	22	44	30	57	32	61
3.	Mg + Al + Zn + Misch Metal	53	76	49	78	51	75
4.	Imported alloy (AZ 31)	60	79	58	79	59	80

Anodic polarisation of magnesium & its alloys.

Magnesium & Its alloys	0.01% Nacl		3% Nacl		2N Nacl		2N $Mg(ClO_4)_2$	
	Polarisation		Polarisation		Polarisation		Polarisation	
	1 mA/cm^2	10 mA/cm^2	1 mA/cm^2	10 mA/cm^2	1 mA/cm^2	10 mA/cm^2	1 mA/cm^2	10 mA/cm^2
1. Magnetium	780 mV	polarised to + 3.6V	60 mV	250 mV	20 mV	90 mV	80 mV	310 mV
2. Mg + Al + Zn	650 mV	polarised to 2.4 V	20 mV	90 mV	60 mV	120 mV	70 mV	250 mV
3. Mg + Al + Zn Misch metal	80 mV	400 mV	10 mV	60 mV	10 mV	50 mV	70 mV	210 mV
4. AZ-31 Imported alloy	200 mV	1200 mV	10 mV	100 mV	10 mV	50 mV	40 mV	190 mV

The following are the main advantages of the invention.

1. Commercial grade magnesium can be used for making magnesium alloy suitable for use as galvanic anode.

2. The direct incorporation of misch-metal in a low melting alloy of magnesium, alumium and zinc is easy, unlike that of mangenese which has a high melting point.

3. The anode efficiency of the magnesium alloy containing misch-metal in sodium chloride solution and in magnesium perchlorate solution is comparably to that of a typical imported alloy, namely AZ 31, particularly at the high current density.

4. The anodic polarisation of the new alloy in 0.01% and 3% chloride solutions is more favourable for use as galvanic anode than the imported alloy AZ 31 and is comparable to AZ 31 in 2N sodium chloride and in 2N perchlorate solutions.

Dated this 5th day of August, 1976.

Sd/-
Asstt Patents Officer,
Council of Scientific & Industrial Research

146925

THE PATENT ACT, 1970

COMPLETE SPECIFICATION

SECTION 10

"Process for the preparation of improved alloy of magnesium for use as galvanic anode"

Council of Scientific and Industrial Research, Rafi Marg, New Delhi-1, India, an Indian registered body incorporated under the Registration of Societies Act (Act XXI of 1860).

The following specification particularly describes and ascertains the nature of this invention and the manner in which it is to be performed :-

This is an invention by Dr. Narayanaswamy Subramanyan, Scientist, Dr. Krishnaswami Balakrishnan, Scientist, Dr. Subramanian Venkatakrishna Iyer, Scientist, and Sri Mahadeva Iyer Krishnan, Previously Junior Scientific Assistant of Central Electrochemical Research Institute, Karaikudi, now student, Electrochemistry Department, Georgetown University, Washington D.C. all Indian citizens.

146925

This invention relates to a process for the preparation of an alloy of magnesium for use as galvanic anode.

Hitherto it has been proposed to prepare magnesium alloy containing aluminium and zinc for use as galvanic anode.

This is open to the objection that these alloys are not efficient unless special precautions are taken to keep down other metallic impurities like iron below specified levels and to counteract the harmful influence of even the minimum amount of iron by addition of maganese. Such alloys, for example 'AZ-31' are being imported at present.

The main object of this invention is to employ commercial grade magnesium for making alloys suitable for use as galvanic anode. According to this invention the process for the preparation of improved alloy of magnesium for use as galvanic anodes characterised in incorporating misch-metal in a magnesium alloy containing aluminium and zinc.

To these ends, the invention broadly consists in the process in which 1 to 5% of misch-metal is incorporated in the alloy made with commercial grade magnesium, commercial grade aluminium (5-10%) and electrolytic zinc (0.5 to 5%).

The alloy developed uses commercial grade magnesium in combination with aluminium, zinc and misch-metal in definite proportions and the alloy so formed has an anode efficiency comparable to that of a typical imported alloy namely 'AZ-31' with low anodic polarisation characteristics.

The following typical examples are given in tabular form to illustrate the invention:

Table-1

Anode efficiency (%) of magnesium and its alloys in different solutions and at different current densities

No.	Anode material	in 3% NaCl at		in 2N NaCl at		in 2N $Mg(ClO_4)_2$ at	
		1 mA/cm^2	10 mA/cm^2	1 mA/cm^2	10 mA/cm^2	1 mA/cm^2	10 mA/cm^2
1.	Magnesium	21	44	17	45	31	57
2.	Magnesium + Aluminium + Zinc	22	44	30	57	32	61
3.	Magnesium + Aluminium + Zinc + Misch-metal	53	76	49	78	51	75
4.	Imported alloy (AZ-31)	60	79	58	79	59	80

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Table-2

Anodic polarisation of Magnesium and its alloys in different solutions

Sl. No.	Magnesium and its alloys	0.01% NaCl		3% NaCl		2N NaCl		2N $Mg(ClO_4)_2$	
		Polarisation		Polarisation		Polarisation		Polarisation	
		1 mA/cm^2	10 mA/cm^2	1 mA/cm^2	10 mA/cm^2	1 mA/cm^2	10 mA/cm^2	1 mA/cm^2	10 mA/cm^2
1.	Magnesium	780 mV	Polarised to +3.6V	60 mV	250 mV	20 mV	80 mV	80 mV	310 mV
2.	Magnesium + Aluminium + Zinc	650 mV	Polarised to 2.4V	20 mV	90 mV	60 mV	120 mV	70 mV	250 mV
3.	Magnesium + Aluminium + Zinc + Misch-metal	80 mV	400 mV	10 mV	60 mV	10 mV	50 mV	70 mV	210 mV
4.	AZ-31 Imported alloy	200 mV	1200 mV	10 mV	100 mV	10 mV	50 mV	40 mV	190 mV

Table - 3

Anode efficiency of the alloy (Mg-Al-Zn-Misch-metal) under cathodic protection conditions

Solution:	..	0.01% NaCl
Cathode	..	Cylindrical steel drum 30 cm dia and 60 cm height
Anode ..	..	1 cm dia and 30 cm long
Anode current density	..	Approximately 10 μA/cm^2
Anode efficiency	..	65 - 70%
Duration of time	..	8 months

The main advantages of the invention are:

i) Indigenously available commercial magnesium metal can be used.

ii) An anode efficiency comparable to that of the imported alloy (AZ-31) can be obtained.

iii) Anodic polarization is less than 'AZ-31'.

Thus an alloy containing commercial grade magnesium, aluminium, zinc and misch-metal in definite proportions has been developed which can give high anodic efficiency and low polarisation characteristics under conditions when used as galvanic anode.

We Claim:

1. A process for the preparation of improved alloy of magnesium for use as galvanic anodes characterised in incorporating misch-metal in a magnesium alloy containing aluminium and zinc.

2. The process as claimed in claim 1 wherein 0.1 to 5.0% of misch-metal is incorporated in the magnesium alloy consisting of magnesium, 5 to 10% of aluminium and 0.5 to 5% of zinc.

3. A process for the preparation of an improved alloy of magnesium for use as galvanic anode substantially as herein described and illustrated.

Dated this 5th day of September 1977.

Scientist E (Patents)
CSIR